AERONAUTICAL AND ASTRONAUTICAL ENGINEER

ROCKET PLUME TOMOGRAPHY OF COMBUSTION SPECIES

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Interest in accurate detection and targeting of aggressor missiles has received considerable interest with the national priority of developing a missile defense system. Understanding the thermal signatures of the exhaust plumes of such missiles is key to accomplishing that mission. Before signature models can be precisely developed for specific rockets, the radiation of the molecular or combustion species within those plumes must be accurately predicted. A combination translation / rotation scanning diagnostic technique has been developed to map the combustion species of a rocket plume and characterize its radiation properties. Using new infrared spectrometer and fiber optic cable technology to transmit the signal spectrum of interest, the custom designed mechanism can sweep through two dimensions of a steady-state rocket exhaust. A glow bar, or blackbody simulator, is shuttered on the opposite side of the plume, allowing the spectrometer to measure both the emission and absorption spectra. This thesis demonstrated the first time use of fiber optic cable to transmit infrared emission / absorption (E/A) spectra from a rocket plume to an infrared detector. This new fiber optic configuration allows for rapid translation and rotation around the rocket plume, establishing the capability for rapid spatial characterization of the combustion species present. Experimental results may then be compared to DoD rocket plume model predictions to highlight areas for improvement.

KEYWORDS: Rocket Plume Exhaust, Spectral Imaging, Emission / Absorption, Combustion Species, Signature

ELECTRICAL ENGINEER

ACTIVE QUEUE MANAGEMENT MECHANISMS
FOR REAL-TIME TRAFFIC IN MANETS
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This thesis develops active queue management mechanisms for real-time traffic for MANETs. Providing QoS for real-time applications is still an open issue as stated in RFC 2309. The proposed packet-dropping algorithm called Selective Early Discard (SED) selectively drops packets in order to spread the packet losses in a queue. Two variations of SED are also examined: one adds priority in order to provide service differentiation and the other utilizes timestamps to enable the intermediate nodes to drop packets that are likely to be unusable by the receiver due to excessive delay. Another scheme that drops bits instead of packets is also investigated.

Using simulation, the new queuing schemes are evaluated in a MANET environment, and their performance is compared with other existing QoS schemes, such as Random Early Discard (RED) and First In First Out (FIFO). Results indicate that SED minimizes the burst errors due to buffer overflow, thereby improving the performance for real-time traffic. SED is also capable of providing service differentiation; additional performance improvement can be realized by utilizing timestamps. Bit-dropping techniques can provide further performance improvements by spreading the error at the bit level (versus spreading the error at the packet level as in SED).

KEYWORDS: Joint Tactical Radio System, Network Simulator 2, Dynamic Source Routing, Quality of Service, Differentiated Services, Mobile Ad-Hoc Network, Real-Time Traffic, Packet Dropping, Bit Dropping, Voice Over IP